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(54) Title: ANTIMICROBIAL WIPE

(57) Abstract: An antimicrobial wipe suitable for the hygienic cleaning of surfaces, which comprises a substrate incorporating an aqueous composition comprising: (i) at least one surfactant, (ii) at least one acid, and (iii) a solvent which is an N-alkylpyrrolidone derivative.

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ANTIMICROBIAL WIPE

Technical Field

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The present invention relates to an antimicrobial wipe which is designed in particular for the hygienic cleaning of surfaces, such as hard surfaces in the household, or in institutional or hospital environments, or the surface of the skin, or fabric surfaces. The wipe contains an antimicrobially active mixture of anionic surfactant and acid, in combination with a specific solvent, and shows improved hygienic cleaning performance.

15

Background to the Invention and Prior Art

Cleaning compositions designed for application to surfaces, such as hard surfaces in the household, or in institutional or hospital environments, or the surface of the skin, or fabric surfaces, generally comprise one or more surfactants, and, optionally, one or more antimicrobial actives and/or solvents.

25 Such surfaces are often contaminated with bacteria and other micro-organisms, which present a risk to human health, especially when they are present near food.

30 The biocidal activity of surfactants is, with a few notable exceptions, low and it is therefore commonplace to add a separate antimicrobial active to compositions.

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The antimicrobial effectiveness of organic acids is known in the literature. Organic acids are utilised in cleaning products to provide antimicrobial activity, but generally do not achieve a sufficient level of bacterial kill, especially
5 when present in formulations at relatively low levels.

Some surfactants have been found to potentiate the effects of organic acids. US 4,975,217 discloses a synergistic germicidal activity for combinations of organic acid and
10 surfactants, when used as active ingredients in germicidal products which are applied directly to the skin.
Citric/malic acid in combination with anionic surfactant is particularly preferred.

15 WO98/55096 discloses that improved germ reduction and improved residual effectiveness can be obtained in a skin cleansing antimicrobial wipe which is impregnated with a mixture of an anionic surfactant and a proton donating agent (such as organic acid), by the addition of a further
20 antibacterial active such as TRICLOSAN.

The present inventors have found that a wipe containing an antimicrobially active mixture of anionic surfactant and acid, in combination with a solvent which is an N-alkyl
25 pyrrolidone derivative, shows superior cleaning performance, particularly with respect to the removal of fatty soil, and gives excellent hygiene performance.

Wipes of this invention are particularly suited for the
30 hygienic cleaning of surfaces such as hard surfaces in the household, or in institutional or hospital environments, or

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the surface of the skin, or fabric surfaces. Surprisingly they provide the requisite level of bacterial kill for this type of application without requiring the addition of any further antibacterial actives such as those described in

5 WO98/55096.

WO95/21238 describes an acidic microemulsion or acidic all-purpose cleaner for hard surfaces which removes soap scum, lime scale and grease which includes an anionic surfactant,

10 at least one organic acid , such as a mono-, di-, or tri-carboxylic acid, and an N-alkyl-2-pyrrolidone. The product is designed to be sprayed onto a surface which is subsequently wiped. There is no mention of antimicrobial efficacy.

15

US 5 470 508 discloses an aqueous oil removal/degreasing composition containing higher-alkyl pyrrolidone such as N-octyl pyrrolidone, anionic surfactant and water.

20 GB 2 230 791 refers to a propylene glycol based solvent, such as propylene glycol t-butyl ether, in combination with N-methyl-2-pyrrolidone, for the removal of grease and varnish from metallic surfaces such as automotive parts.

25 WO98/55569 and WO98/55570 relate to aqueous hard surface cleaners with improved residue removal and reduced filming/streaking. The compositions comprise a mixture of anionic surfactants, an organic solvent such as an alkylene glycol ether, and preferably include a 1-alkyl-2-pyrrolidone
30 for dispersal of fragrance oils and other insoluble organic

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materials in the compositions. The compositions are buffered to pH greater than 6.5 with a nitrogenous buffer.

- EP 0 598 257 describes a water-based solution for reclaiming
5 paint from spray booths with an N-alkyl pyrrolidone,
preferably N-methyl pyrrolidone, a surfactant, preferably
nonionic, and an alkylene glycol monoalkyl ether such as
tripropylene glycol mono methyl ether.
- 10 EP 0 273 594 discloses a disposable semi-moist wipe for
touch-up or light duty cleaning of bathroom or kitchen soil,
containing a liquid cleaning composition comprising anionic
or nonionic surfactant, one or more solvents for oil and
dirt such as N-methyl pyrrolidone and ethylene or propylene
15 glycol ethers, and sufficient hydroxide compound to produce
a composition pH of 8 to 12.

- EP 0 690 906 describes a multi-surface cleaner for the
removal of greasy residues comprising an amine oxide or
20 quaternary ammonium salt surfactant and a polar organic
compound of defined water solubility such as certain of the
propylene glycol ethers and N-alkyl pyrrolidones.

- US 5 332 526 provides an environmentally safe paint
stripping composition comprising N-methyl-2-pyrrolidone and
lower alkyl ethers of propylene glycol and dipropylene
glycol.

- None of the above referenced prior art discloses or suggests
30 the combination of ingredients which characterises wipes of
the present invention as defined below, and the improved

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surface cleaning and hygienic performance obtainable thereby.

Summary of the Invention

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The present invention provides an antimicrobial wipe suitable for the hygienic cleaning of surfaces, which comprises a substrate incorporating an aqueous composition comprising:

10

(i) at least one surfactant,

(ii) at least one acid, and

15 (iii) a solvent which is an N-alkylpyrrolidone derivative.

Detailed Description of the Invention

20

Product Form and Ingredient Levels

Wipes of the invention are especially suitable for the hygienic cleaning of hard surfaces. By "hard surfaces" is meant those surfaces which are typically found in the household, or in institutional or hospital environments, and which are prone to microbial contamination. Examples include lavatory fixtures, lavatory appliances (toilets, bidets, shower stalls, bathtubs and bathing appliances), wall and 25 flooring surfaces and those surfaces associated with kitchen 30

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environments and other environments associated with food preparation.

Wipes of the invention are also useful in laundry or
5 personal care applications where an antimicrobial effect is desirable, such as hygienic stain removal products for fabrics, or hygienic products for the skin such as antimicrobial hand cleansing products.

- 10 By "wipe" it is meant a disposable substrate such as a porous or absorbent sheet or cloth which has been pre-treated with the aqueous composition comprising ingredients (i), (ii), and (iii) as defined above (hereinafter referred to as "the composition of the invention") so as to
15 incorporate the composition of the invention into or onto the substrate prior to its use by the consumer.

This product form is particularly advantageous since it allows for safe and convenient one-step hygienic cleaning
20 disinfection of surfaces by the user, without the need for dilution or spraying.

Typically the wipe is formed by absorbing the composition of the invention onto the substrate to form a moist wipe. A
25 batch of wipes can then be placed in a container which can be opened when needed and when closed, sufficiently seals to prevent evaporation of any components from the composition. The composition of the invention is impregnated at the desired weight onto one or both sides of a substrate which
30 may be formed from any woven or nonwoven fibre, fibre

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mixture or foam of sufficient wet strength and absorbency to hold an effective amount of the composition.

Preferable materials used to form the substrate include in general all nonwoven materials with sufficient liquid absorption capacity to contain the aqueous composition of the invention and to deliver it in use.

Illustrative examples of suitable nonwoven materials include fibres from natural sources such as viscose, cellulose, or from synthetic origin such as polypropylene or polyester. Especially suitable are mixtures of these materials such as viscose/polyester, viscose/polypropylene, and cellulose/polyester.

Optionally one or more latex binders can be added.

These latex binders can typically include one or more monomers selected from styrene-2-ethyl hexyl acrylate, butyl acrylate, methyl methacrylate, ethyl acrylate, methyl acrylate, acrylonitrile and vinyl acetate.

The materials can be formed into webs using technologies generally known in the art such as carding, drylaid, wetlaid, airlaid and extrusion.

Webs can be bonded using technologies known in the art such as needlepunch, stitchbond, hydroentangling, chemical bonding, thermal bonding, spunbinding and meltblowing.

A commercially available example of a suitable material used to form the substrate is Akena VPE ex Orlandi, (a

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viscose/polyester material available in different specific weights varying from 40 grams/sq. m to 150 grams/sq. m).

Other commercially available examples include Tecnojet C500,

5 a spunlace material containing 70% viscose and 30% polyester of a specific weight of 50 grams/ sq. m, available from Tecnofibra, Tecnojet A 1000, a material containing 100% viscose with a specific weight of 100 grams/ sq. m, available from Tecnofibra, and Hydraspun 8579, a nonwoven
10 fabric manufactured from a blend of cellulosic and synthetic fibres with a specific weight of 48 grams/ sq. m.

Compositions of the invention will typically have ingredient percentages (by weight based on total weight) as follows:

15 Surfactant: from 0.1 to 2%, preferably about 0.3%

Acid: from 0.1 to 2.0%, preferably from 0.4 to 0.8%.

20 N-alkylpyrrolidone derivative: from 0.05 to 2%, preferably from 0.2 to 0.6%.

Water: at least 80%, preferably at least 90%.

25 In a wipe according to the invention, the weight ratio of composition of the invention to substrate suitably ranges from 1:1 to 6:1, and is preferably from 1:1 to 4:1, more preferably from 2:1 to 3:1.

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Compositions

The ingredients of the compositions of the invention will be further described as follows:

5

Water

Compositions of the invention are aqueous compositions which preferably contain relatively low levels of actives.

10 Typically the principal ingredient is water, which is normally present at a level of at least 50%, preferably at least 80%, more preferably at least 90%, by weight based on total weight. The use of distilled or demineralised water is preferred, but not essential to the invention.

15

Surfactant

Compositions of the invention contain a surfactant which is preferably anionic in nature.

20

Suitable anionic surfactants for use herein include alkyl sulphates, alkyl sulphonates, alkyl aryl sulphonates, alkyl alkoxylated sulphates, or mixtures thereof.

25 Alkyl sulphates are particularly preferred.

Suitable alkyl sulphate surfactants for use herein are represented by the formula $RSO_4 M$ wherein R represents a hydrocarbon group which may suitably be a straight or branched alkyl radical containing from 6 to 20 carbon atoms, or an alkyl phenyl radical containing from 6 to 18 carbon

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atoms in the alkyl group. Preferably R is a straight or branched alkyl radical containing from 6 to 20 carbon atoms. M is hydrogen or a cation such as an alkali metal cation (e.g., sodium, potassium, lithium, calcium, and magnesium) 5 or ammonium or substituted ammonium (e.g., methyl-, dimethyl-, and trimethyl ammonium cations and quaternary ammonium cations, such as tetramethyl-ammonium and dimethyl piperidinium cations and quaternary ammonium cations derived from alkylamines such as ethylamine, diethylamine, 10 triethylamine, and mixtures thereof).

An example of a commercially available branched alkyl sulphate is DACPON 27-23 AL, ex CONDEA. This material can be described as a branched, essentially C₁₂/C₁₃ sodium alkyl 15 sulphate of formula (R₁)CH(R₂)-OSO₃Na where R₁ is C₁₋₄ alkyl and R₂ is C₈₋₁₁ alkyl.

An example of a commercially available linear alkyl sulphate is EMPICOL LX28, ex Albright & Wilson. This material can be 20 described as R-OSO₃Na where R is C₁₀₋₁₆ alkyl, mainly C₁₂₋₁₄ alkyl.

Suitable alkyl sulphonates for use herein include water-soluble salts or acids of the formula RSO₃M wherein R is a 25 C₆-C₂₀ linear or branched, saturated or unsaturated alkyl group, preferably a C₈-C₁₈ alkyl group and more preferably a C₁₀-C₁₆ alkyl group, and M is hydrogen or a cation such as those listed above for alkyl sulphate surfactants.

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An example of a commercially available C₁₄-C₁₆ alkyl sulphonate is HOSTAPUR SAS ex Hoechst.

Suitable alkyl aryl sulphonates for use herein include
5 water-soluble salts or acids of the formula RSO₃M wherein R is an aryl group, preferably a benzyl group, substituted by a C₆-C₂₀ linear or branched saturated or unsaturated alkyl group, preferably a C₈-C₁₈ alkyl group and more preferably a C₁₀-C₁₆ alkyl group, and M is hydrogen or a cation such as
10 those listed above for alkyl sulphate surfactants.

Examples of commercially available alkyl aryl sulphonates are the alkyl benzene sulphonates available from Albright & Wilson under the trade name NANSA.

15 Suitable alkyl alkoxylated sulphate surfactants for use herein are according to the formula RO(A)_mSO₃M wherein R is an unsubstituted C₆-C₂₀ alkyl or hydroxyalkyl group having a C₆-C₂₀ alkyl component, preferably a C₈-C₁₈ alkyl or hydroxyalkyl, A is an ethoxy or propoxy unit, m is greater than zero, typically between 0.5 and 6, more preferably between 0.5 and 3, and M is H or a cation such as those listed above for alkyl sulphate surfactants.
20

25 An example of a commercially available alkyl alkoxylated sulphate surfactant is EMPICOL ESA 70, ex Albright & Wilson. This material can be described as
RO-(CH₂CH₂O)SO₃Na where R is C₁₀₋₁₆ alkyl, mainly C₁₂₋₁₄ alkyl.

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Acid

Compositions of the invention contain an acid which is preferably organic in nature.

5

Suitable organic acids for use herein include carboxylic acids and mixtures thereof.

The carboxylic acids and mixtures thereof may suitably be
10 selected from aliphatic, cycloaliphatic or aromatic mono-, di-, tri- or polycarboxylic acids which generally contain 2 to 10 carbon atoms, preferably 3 to 6 carbon atoms in the molecule. Hydroxycarboxylic acids may also be used.

15 Examples of suitable carboxylic acids include caprylic acid, propionic acid, azelaic acid, caproic acid, hydroxybenzoic acid, salicylic acid, malic acid, maleic acid, fumaric acid, succinic acid, glutaric acid, adipic acid, tartaric acid and mixtures thereof.

20

Espcially preferred are mixtures of dicarboxylic acids, in particular mixtures including adipic, glutaric and succinic acid. These mixtures are preferred as they are commercially available. Typical commercially available mixtures comprise
25 30-35% adipic acid, 45-50% glutaric acid and 10-18% succinic acid. Such a mixture is available as SOKALAN DCS ex BASF. Another suitable mixture is available as RADIMIX ex Radici.

The use of essentially pure acids is not excluded but these
30 have limited commercial availability.

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N-alkylpyrrolidone derivative

Compositions of this invention contain an N-alkylpyrrolidone derivative.

5

Suitable N-alkyl pyrrolidone derivatives are N-(n-alkyl) pyrrolidones where the alkyl group has from 6 to 20, preferably from 8 to 14 carbon atoms.

10 Preferred N-alkyl pyrrolidone derivatives are N-(n-octyl)-2-pyrrolidone, N-(n-decyl)-2-pyrrolidone, N-(n-dodecyl)-2-pyrrolidone and N-(n-tetradecyl)-2-pyrrolidone.

Particularly preferred is N-(n-octyl)-2-pyrrolidone, 15 available commercially as SURFADONE LP-100 ex International Speciality Products, Inc.

pH

20 Compositions of the invention will generally have a pH between 3.0 and 6.0, preferably 3.2-4.5.

It is believed that the relatively low pH of the composition is important in achieving both the cleaning and the 25 antimicrobial synergies which are exhibited by the composition of the invention. However below pH 3.0 surface damage may occur. The most preferred pH is around 3.8.

A water soluble base such as an alkali metal hydroxide, 30 (typically sodium hydroxide) is generally used to regulate the pH to the required level.

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Optional Ingredients

Compositions of the invention can contain other optional ingredients which aid in their cleaning performance and

5 maintain the physical and chemical stability of the product.

Examples include: further solvents, perfumes, colours and dyes, further hygiene agents, foam-control agents, viscosity modifying agents and mixtures thereof.

10

A preferred optional ingredient for inclusion in compositions of the invention is a further solvent which can be characterised by the general formula $R_1-O-(EO)_m-(PO)_n-R_2$, wherein R_1 and R_2 are independently C_{2-6} alkyl or hydrogen, but not both hydrogen, m and n are independently 0-5, EO represents an ethyleneoxy group and PO represents a propyleneoxy group.

15 A preferred example of such a further solvent is propylene glycol n-butyl ether, sold by Dow Chemical Company as Dowanol PnB. Other suitable materials include Dowanol PM and Dowanol DPnB, both also commercially available from Dow Chemical Company.

20 25 The level of further solvent in compositions of the invention (by weight based on total weight) suitably ranges from 0.05 to 5%, preferably from 0.1 to 3%, more preferably from 0.2 to 5%.

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The invention will now be illustrated by the following non-limiting Examples, in which all percentages are by weight based on total weight, unless otherwise indicated.

5 **EXAMPLES**

Example 1

A liquid formulation was prepared having ingredients as
10 shown in the following Table:

INGREDIENT	wt%
Demineralised Water	to 100
Isopropyl alcohol	1.800
Propylene glycol mono-n-butyl ether (Dowanol PnB, ex Dow)	0.300
N-(n-octyl)-2-pyrrolidone (Surfadone LP100, ex ISP)	0.400
Primary alkyl sulphate 28% active (Dacpon 27-23 AL, ex Condea)	0.536
Mix of acids (Sokalan DCS, ex BASF)	0.600
Sodium hydroxide 50% active	0.050

An antimicrobial wipe was formed by impregnating a substrate with the above liquid formulation. The substrate was
15 spunlace of specific weight 50 grams/sq. m (Akena VPE 50, ex Orlandi). The liquid formulation to substrate weight ratio was 2.6:1.

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Disinfecting performance was measured by separating the liquid formulation from the substrate after 24 hours impregnation time and evaluating it for bactericidal activity using the methodology described in European
5 standard EN 1276. This specifies a test method and requirements for the minimum bactericidal activity of a disinfecting composition. The liquid formulation passed this test at high soil with 5 minutes contact time, giving at least log 5 kill against the test bacterial strains
10 *P.aeruginosa, E.coli, S.aureus and Ent.hirae.*

Examples 2 & 3

Examples 2 and 3 (compositions according to the invention)
15 and Comparative Examples A and B (compositions not according to the invention) were prepared.

Each composition was used to make an antimicrobial wipe by impregnating a substrate with that particular composition.
20 The substrate was spunlace comprising viscose/polyester at a ratio of 70:30 with a specific weight of 50 grams/sq. m. In each case, the composition to substrate weight ratio was 2.6:1.
25 The compositions were evaluated for their cleaning performance on fatty soil. The following Table shows the ingredients of the compositions used and the results of the evaluation of cleaning performance:

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	Comparative Example A	Example 2	Example 3	Comparative Example B
Ingredient	wt%	wt%	wt%	wt%
Isopropyl Alcohol	2.0	2.0	2.0	2.0
Monopropylene glycol n-butyl ether	1.0	0.5	-	-
Dipropylene glycol n-butyl ether	-	-	0.5	1.0
N-octyl pyrrolidone	-	0.5	0.5	-
Mix of acids ⁽¹⁾	0.4	0.4	0.4	0.4
Primary alkyl sulphate	0.3	0.3	0.3	0.3
Perfume	0.15	0.15	0.15	0.15
Water	96.15	96.15	96.15	96.15
Cleaning performance on scale 1-10 1= poor 10= excellent	7	9	9	8.5

It can be seen that Examples 2 & 3 are both superior to

- 5 Comparative Example A and Comparative Example B in terms of their cleaning performance on fatty soil.

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CLAIMS

1. An antimicrobial wipe suitable for the hygienic cleaning of surfaces, which comprises a substrate incorporating an aqueous composition comprising:
 - (i) at least one surfactant,
 - (ii) at least one acid, and
 - (iii) a solvent which is an N-alkylpyrrolidone derivative.
- 10 2. A wipe according to claim 1, in which the surfactant is an anionic surfactant selected from alkyl sulphates, alkyl sulphonates, alkyl aryl sulphonates, alkyl alkoxylated sulphates, or mixtures thereof.
- 15 3. A wipe according to claim 1 or 2, in which the acid is a carboxylic acid selected from caprylic acid, propionic acid, azelaic acid, caproic acid, hydroxybenzoic acid, salicylic acid, malic acid, maleic acid, fumaric acid, succinic acid, glutaric acid, adipic acid, tartaric acid and mixtures thereof.
- 20 4. A wipe according to any of claims 1 to 3, in which the N-alkyl pyrrolidone derivative is selected from N-(n-octyl)-2-pyrrolidone, N-(n-decyl)-2-pyrrolidone, N-(n-dodecyl)-2-pyrrolidone and N-(n-tetradecyl)-2-pyrrolidone.

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5. A wipe according to any of claims 1 to 5, which has a pH between 3.0 and 6.0.

6. A wipe according to claim 5, which has a pH between 3.5
5 and 4.5.

7. A wipe according to any of claims 1 to 6, in which the aqueous composition includes a further solvent of the general formula $R_1-O-(EO)_m-(PO)_n-R_2$, wherein R_1 and R_2 are independently C_{2-6} alkyl or hydrogen, but not both hydrogen, m and n are independently 0-5, EO represents an ethyleneoxy group and PO represents a propyleneoxy group. Has a pH between 3.0 and 6.0.
10

15 8. A wipe according to any of claims 1 to 7, in which the weight ratio of aqueous composition to substrate ranges from 1:1 to 4:1.

20